Environment proof treatment for Electro-Luminescent (EL) element(s)

This application is a continuation-in-part of U.S. Patent Application Ser. No. 10/170,584, filed June 14, 2002 and Ser. No. 10/285,451, filed Nov. 4, 2002 and Ser. No. 10/ 286,820, filed Nov. 4, 2002.

BACKGROUND OF THE INVENTION

The current invention relates to EL-element(s), which may include a panel, tube, or strip, and which are suitable for consumer applications such as those involving a Shoe, Slide, Slipper, Sandal, Automobiles, Boat, Bus, Aircraft, Garden, Traffic Equipment, Bag, Purse, House, Building, Christmas, Seasonal, Bicycle, Tricycle, Toy, Moving Device, Skating, Jogging, Watch, Garment, Apparel, Clothing, Jeans, Box, Tool Box, Working Lamp, Furniture, Giftware, Headgear, Jewelry, Hair Accessories, Partyware, Signs, Indoor lighting, Outdoor lighting, Street Lamp, Guide Lamp, Bridge Lamp,

Traffic Cone, New Jersey Deck, Fence, Mail Box, House Number Light, Window Sign, Wall Sign, Poster, Pathway, Stair, Curb, Line Divider for People, Evacuation Light, Fishing Marker, Decoration Device for Safety, Decorating, Advertisement, Promotion, Point-Of-Purchase, Warning Light, Accent Light, Illumination light, Floor light, Delineator Guide Light, Evacuation light, Night light, Multiple Function Light, or Portable Light(s) which can be found in the market place with other light means such as L.E.D./Incandescent light bulb/ fluorescent tube, Neon Tube, HID lamp etc.

The current invention uses EL-elements having sufficient light brightness with very low power consumption as described in the current inventor's variety of issued US patents including US 5,746,504, 5,980,060,5,722,760, 5,504,397, 5,475,574, 5,479,325, 5,570,946, 5,469,342, 5,570,945, 5,704,705, 5,611,621, 5,860,727, 5,865,523, 5,879,069, 5,572,817, 5,752,337, 5,794,366, 5,833,508, 5,688,038, 5,871,269, 5,720,651, 5,806,960, 5,947,980, 5,775,016, 5,566,384, 5,876,108,

5,836,671, 5,601,358, 5,754,064, 5,921,653, 5,667,394, 6,082,867, 6,170,958, 6,183,101, 6,171,117, 5,926,440, 6,158,868, 6,182,282, 6,179,431, 5,599,088, 5,213,616, 6,169,431, 6,280,053, 6,170,958, 6,168,282, 5,926,440, 5,683,164, 6,183,101, 6,123,616, 6,280,053, 5,926,440, 5,754,064, 5,879,069 and other issued patents owned by the current inventor.

The advantages of using electro-luminescent(EL) lighting elements in a variety of contexts are explained in several co-pending US patent applications including US patent application Ser. Nos. 08/305,294; 08/343,404; 08/343,915; 08/383,404; 08/383,405; 08/409,925; 08/421,647; 08/432,707; 08/438,373; 08/444,064; 08/436,007; 08/489,160; 08/498,258; 08/510,701; 08/522,940; 08/561,973; 08/611,049; 08/614,001; 08/522,940; 08/712,484; 08/734,872, which cover more uses for electro-luminescent (EL) element(s).

None of the listed inventions and conventional market applications provide electro-luminescent elements

that are fully environment-proof, which means that they cannot overcome damage due to ultra-violet light, humidity, moisture, and electrical short circuits, all of which can cause loss of designed functions. Hence, the co-pending parent applications, which are directed to weather-proof treatments, offer substantial improvement over the prior art with respect to problems caused by moisture, humidity, and the like. Nevertheless, there is a need for additional improvements, including the following:

1. The EL-elements may be sealed by a plastic resin process such as injection, pouring, or curing of a conventional plastic resin material selected from the group including PC, PP, PS, PE, PVC, PU, PET, POLY, Silicone, or any chemical resins, particles, or liquid that enables the EL-element(s) to be sealed inside to provide environment-proof properties.

2. Optical effects may be provided such as Reflective, Retro-Reflective, Random Reflective,

Magnify image, Reduce image, Focus Arrangement, Total Reflective, Diffusion, Filter, and Radiation theory effects, and all technical variations related to material transparency, finesses of surfaces, angle of light beams traveling, Material Thickness, Material color and so further may be utilized to make electro-luminescent (EL) element(s) of different geometric shape(s) exhibit eye-catching effects for visual viewing.

3. Further improvement may be made in the circuit technology that provides desired functions such as fade in and out, chasing , sequential flashing, pair flashing, scan, pause, and setting of on and off intervals to meet market requirements.

4. Further, the current invention may incorporate other light means selected from conventional commercially available light sources such as LED, HID, Bulb, Fluorescent, Cold-Cathode tube, Violet tube, Bulb Tube light, and LOD, to make the desired combination light meet market requirements.

5. The current invention also can create a workable sealing incorporating the co-pending patents' concept of using center buss-wires as the electric-signal(s) delivery means with super low electric-resistance to connect each electro-luminescent (EL) element electrode to one of the buss-wires. Each element's electrode may be connected with one of buss-wires, and the number of element's electrodes and buss-wires may be varied according to market requirements.

These improvements enable the electro-Luminescent (EL) element(s) to be sealed inside the plastic resin(s) by a pre-determined procedure that takes into account optics theory with desired transparency, color material, surface fineness polishing process, Shape of material for creating desired image effects, thickness of material to form the image result, and geometric shapes resulting in a variety of light emitting and traveling paths so that desired light effects can be created for all devices with super environment-proof quality. Furthermore, a 2nd

light means can be added for more attractive light effects to meet the consumer's expectation.

Based on these (5) Major features and improvements, the current invention solves the environment problem that has held-up widespread acceptance of electro-luminescent elements for the past two decades.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig 1 show a 1st embodiment of electro-luminescent (EL) element(s) in a preferred twisted tube shape and sealed inside of the plastic resin(s) by injection procedure for footwear application.

Fig 2A illustrates a 2nd embodiment including an arrangement to seal twisted electro-luminescent (EL) elements inside the plastic Piece.

Fig 2B illustrates a 3rd embodiment including an arrangement to seal the plurality of flat shaped

electro-luminescent (EL) elements inside a plastic piece with optical properties on the piece for changing the light image. .

Fig 2C illustrates a 4th embodiment including an arrangement to seal the flat strip of electro-luminescent (EL) element into a plastic piece with a with a number of grooves to provide optical effects at proper locations.

Fig 2D illustrates a 5th of embodiment including an arrangement to seal the electro-luminescent (EL) element, with the connection-area also sealed into the plastic piece .

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Fig 2E illustrates a 6^{th} of embodiment including an arrangement to seal the plurality of electro-luminescent (EL) elements in a fork-shaped enclosure which has a desired pitch-distance of each lit-area and one area having all the elements' electrodes to connect with the conductive-means to get electric signals.

Fig. 3 discloses a procedure for sealing the said element(s) inside the desired plastic resin(s) materials, including provision of a heat-transfer film which facilitates addition of artwork, color, indicia, designs on the plastic piece within seconds while applying a 2nd injection process.

Fig 4A-4Dillustrates a preferred embodiment of an optics arrangement for the plastic piece to provide visual effects and desired light effects by controlling plastic material thickness, transparency properties of the plastic material, plastic piece finesses, Convex or Concave design, addition of other materials of chemicals to get diffusion effects, as well as the addition of Silkscreen(s), Masking(s), Window(s), Stencil(s), Cut-Out(s), Opening(s) to sections of the plastic piece corresponding to EL-element(s) lit-areas positioned to get desired effects.

Fig 4D illustrates sealing procedures of the preferred embodiment for micro-injection applications

which use a pouring process and not an injection machine, as well as a stitching-edge for a contour that can easily be added on any application's surface.

Fig 5 illustrates an embodiment including electro-luminescent (EL) element(s) sealed inside a plastic piece and a method to connect a plurality of number of such sealed Electro-luminescent (EL) element(s) into a desired length, loop, linear, configuration, path, or route by a variety of shaped connectors which make a desired linear arrangement.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The preferred environment proof treatment for the geometric designs or shape of Electro-Luminescent element(s) involves sealing the said element(s) inside the plastic resin(s) by an injection process or the preferred and equivalent of method may include pouring or

hand-operation of such process to ~~to~~ properly EL-element(s).

The plastic resin(s) or particle(s) are individual pieces and will become a single piece after the resin(s), particle(s) have been treated at a predetermined temperature, pressure, heating, and timing with appropriate tooling. All of these factors are controlled to be compatible with the electro-luminescent (EL)-element(s) properties to seal the said elements within the plastic piece with designed light brightness, appearance, and viewing effects, and to overcome environment damage that may be caused by nature or human forces including damage due to humidity, water, temperature, ultra-violet rays, impact strength, bending, deforming, pulling, breaking, heat, stitching, and any other effects that might cause the said element(s) to lose their designed function(s), light output(s), brightness, and color(s).

The preferred procedure for high efficiency and less labor is to accomplish the sealing by using an injection machine. The tooling for this plastic injection may be designed to hold the EL-elements well before injection and carry out one injection process to make nice and good sealing. This procedure and tooling design is not discussed in detail herein since it is conventional in a variety of applications. Properly controlling the injection timing, temperature, pressure and selecting the plastic resin(s) to match the EL-element(s) properties will enable the EL-elements to be visible within the plastic piece. Alternative to one-time injection, the injection procedure can use multiple steps, for example to provide the 1st injection piece with pre-designed groove(s), ditch(s), and/or Shallow Area(s) and install the geometric element(s) inside the groove(s), ditch(s), and/or shallow area(s) prior to the 2nd injection procedure to seal the EL-elements.

Furthermore, the injection procedure can be carried out a plurality of times by machine or human operation to accomplish a desired result such as Micro-Injection

Application which uses a predetermined tooling and multiple different color resin(s) and liquid Chemical materials to inject into all the shallow areas(s), groove(s), and/or ditch(s) to accomplish a variety of effects beyond those that can be obtained with two-time injection. By selecting an appropriate liquid chemical(s) for the micro-injection procedure, the sealing technique need not be limited to the plastic resin(s) particle(s) but also but also may be used for different constructions of the plastic in solid or liquid forms. A variety of choices from the market place may be selected, including PC, PP, PVC, PE, PS, Acrylic, PET, PU, Rubber, Silicone, which are refined from petroleum, or a related material such as Rubber from trees, or hydrocarbons other than petroleum from ancient animals under ground, any of which may be considered to apply to the invention. The invention may also utilize Chemical or plastic resin(s), article(s), and liquid(s) other than those noted above to join materials to form composite materials.

The each electro-luminescent EL-element(s) have output-end(s) in the form of area(s) including a Common-electrode and desired positive electrode(s). It is conventional for the negative or common electrode to be formed as an ITO layer. The conventional market prefers to use Silver paste to make connection with different lit-area(s) phosphor to form the Positive electrode (Lit-area(s)'s electrodes). All these electrodes of the element(s) can be connected with metal terminals and a flexible Printed Circuit (FPC) by means including punch, contact, or conventional available methods to build the signal(s) delivery means. Such connection points may be sealed inside the plastic piece or outside the plastic piece depending on the application so that the electrical connections may be partially sealed or optionally selected to be sealed within or outside the plastic Piece. There are also many additional considerations base on different requirements for different applications. The EL-element(s) can for example be pre-formed as a twisted EL panel tube light corresponding to that described in the Applicant's co-pending filing. From Fig. (1), one can see that the

twisted tube EL-element(s) are sealed inside plastic but pre-twisted so as to allow the EL-element(s) to be sealed inside an "L" shaped plastic Piece. Preferably, the Panel, Sheet, or Strips for "L" Shape bending are arranged to illuminate the plastic piece on proper orientation, as shown in Fig 2C. This can accomplished using optics theory to make light be visible with excellent results as indicated in Fig 4A, Fig 4B, and Fig 4C.

The light effects of said element(s) are achieved when proper sealed by the plastic piece due to appropriate design and selection of the resin(s), particles(s), liquid(s), the thickness of the plastic material (Fig 4A, 4B, 4C), fineness of surface(not shown), Transparency of Material, Diffusion grade, Diffusion material added (Fig 4C), other particle(s) added, Shape of the plastic piece, and other normal light means treatment. Most important is that all sealing procedures have to match the EL-element(s) properties, including the EL-element(s) deforming temperature, ink properties, phosphor properties, lamination properties, tightness of lamination,

minimum bending radius and all other factors which must be taken into account to prevent the L-element(s) from been damaged by the sealing processes. The visual parameters affected by the sealing processes may include image, size, brightness, clearance, color, direction. These effects may be combined with the inventor's earlier patented concept for positioned the said element(s) with front window(s), cut-out(s), and Silkscreen area(s). The current invention can also have all these treatments on the plastic surface to make desired light effects with indicia(s), Character(s), design(s), art-work(s) for advertisement purposes. These treatments can be obtained using simple tooling designs (Fig. 3), masking (Fig 3), stencil, silkscreen printing (Fig. 4B), and/or surface treatment of the plastic by conventional techniques. Further more, the transfer ink film technique also can utilize the injection machine so as to modify the Plastic-Piece's surface to have a desired appearance while using conventional techniques for simple masking to vary color, design, and indicia. Other material or particles (Fig. 4C) such as Small metal pieces, metal powders,

particles within the chemical's resin(s), particle(s), and/or liquid(s) can also be added or mixed together to provide diffusion objects inside the plastic piece so the light beam will be reflective in all directions and cause more splendid light effects for the viewer.

Additional light-means that may be incorporated include conventional light means such an LED, Bulb, Organic electro-Luminescent, Organic LED, and LOD powered by batteries, which can supply enough life time for the applications. The additional light means may be sealed together with the electro-luminescent element(s) to provide for other taste and visual effects.

This is the big improvement for the environment of the element(s) and other light means for certain applications.

In more detail, Fig. 1 shows twisted element(s) sealed inside Plastic-piece (01). The twisted EL-element (011) may be the same as those described in co-pending

U.S. Patent Application Ser. Nos. 10/170,874, 10/285,451, and 10/286,820. The twisted element(011) are twisted around central electric-wire(s)(012), and the electrodes (not shown) of the element(s) are connected with central electric-wire(s) (011) and outside electric-wire(s) (014) through an appropriate connection method such as the use of Clamp- terminals (not shown), which are punched through the EL-element(s) electrode(s) and held to allow a soldering process to be carried out. This is one preferred method. The alternative is to use a Flexible Printing Circuit (FPC), which can use Silver Paste to glue, curing with the electro-Luminescent element(s) electrode so as to enable the soldering procedure to be carried out. One can also use a Printing Conductive material such as Silver Paste having a higher electric resistance for this arrangement. Those skilled in the art will appreciate that the EL-element's electrode(s) and the corresponding electrical connections may be constructed using a lot of alternative currently-available methods, and that the invention is not limited to this preferred embodiment discussion. As shown in Fig (1), the EL-element(s)

electrode(s) are connected with electric wire(s) (012) (014) to form the electric Signal(s) delivery means. This connection-area (013) provides a durable electric connection and is sealed by shrink-tube or hot-glue, silicone, epoxy, tape, or paper tape to hold all connection-area(s) well. The Connection-area (013) is the weak area for a whole EL-element(s) application, especially with respect to waterproofing requirements, but the current invention solves this problem because this connection-area (013) is well sealed inside the Plastic-piece . From Fig. 2A, the Plastic-piece (021) is injected at an earlier time and with a groove (027) which allows the twisted EL-element (024) to be installed well within the groove (027) because the groove (027) is a little smaller than the diameter of twisted EL-element (024) so that the twisted EL-element can fit into groove very tightly and prevent the twisted EL-element (024) from deforming or loosening. The EL-element (024) is twisted around the center Buss-wires (023) which carry electric-signal(s) with very low electric-resistance to supply expected electric-signals with sufficient power to

turn on the EL-element(s) for super brightness. The Center Buss-wire(s) (025) are connected with EL-element electrodes. The outside conductive-means (029) may also be connected with another EL-element electrode to build the electric-circuit to control additional light function(s). The Twisted EL-element (024) has emits light in an outward direction to cover 360 degrees and thereby provide a neon light effect. The twisted EL-element (024) and its connection-area (028) are then installed and put into an injection machine to make a 2nd injection and allow the 2nd injected part (022) to join with the 1st injected part (021) without any gap or hole to provide a quality environmental seal and prevent the humidity, water, bending, and impact from causing damage to the EL-element or connection-area.

As illustrated in Fig 2B, the 1st injected part (2B) has two shallow areas (2B01) and (2B02) which accommodate the two piece flat EL-Elements. Each EL-element has its selected lit-areas (2B04), (2B05), (2B06), (2B07), (2B08) which have a phosphor coated

thereon and which are positioned with the 2nd injection part's related areas (A), (B), (C), (D), (E), each area having a different optics lens design. For example, area (A) is a square raised lens positioned over lower Star lit-areas, (B) is a raised shaped lens to positioned over lower AARON lit-areas, (C) is a rectangular raised lens positioned over a lower FLOWER lit-area, (D) is a round raised lens positioned over a lower THUNDERBOLT lit-area, (E) is a cylindrical raised lens positioned over a lower ROUND lit-area. The 2nd injection piece has certain location with window(s) positioned over lower EL-element's lit-areas. This is described in the current inventor's early issued patents US5,572,817, US5,794,366, US5,752,337, US5,833,508. The connection-area (2C) and (2D) is also installed on the shallow areas (2B02) and (2B01), and sealed during the 2nd injection so all these most weak areas are also sealed and get good protection.

As shown in Fig 2C, the 1st injection plastic-part (2C01) has toothed areas to create desired light

effect(s).The 2nd injection part (2C02) has a smooth radius surface so that the device can be comfortably worn when the device is applied to a sandal. The 1st injection part (2C01) has the groove for the EL-element in strip form (2C10) to facilitate installation. The EL-element (2C10) emits light outwardly to form the word AARON as shown. The preferred arrangement is to cause the EL-element to have a loop to follow the contour of the injection plastic-piece with the wider shallow area (2C08) and allow the EL-element's connection-area (2C06) to be well installed. The two EL-element's electrodes (2C11) and (2C12) connected with outside conductive-means (2C05) are sealed well within the shallow area (2C08) after the 2nd injection is applied to the 1st injection part.

From Fig 2D, the 1st injected-part (2D01) has a shallow area (2D07) to install the EL-element (2D03). The wider shallow area (2D05) enables installation of the connection-area (2D06) including the EL-element's 4 electrodes, 4 soldered points, 4 outside conductive-means, which are pre-sealed by shrink-tube. The 1st injected part

(2D01) has a geometric shape to allow light to be emitted outside with a desired viewing angle. Similarly, the 2nd injected part (2D02) also has optics designs.

As shown in Fig 2E, the 1st injected part (2E01) and 2nd injected part (2E02) have a convex lens design to let the light image become bigger based on optics theory. The 1st injected part (2E01) has shallow-areas (2E03) to allow installation of an EL-element which has a fork design with 3 lit-areas (2E06) (2E07) (2E08) and a pitch-distance sufficient to make a special design and colors. The wider shallow-areas (2E04) (2E05) allow the connection-area to fit well within the plastic-piece. The connection areas have 4 EL-element's electrodes (2E09), 4 outside connective-means (2E10), and 4 soldered points (not shown), which are sealed within the shrink-tube (2E11). The flat EL-element does not have the center buss-wires which are used for the Twisted EL-element of Fig (1) and Fig (2A).

As shown in Fig 3, the 1st injected part (032) has a plurality of pre-installed EL-elements (033) in the 1st injected part (032). The conductive-means (034) are outside the plastic-piece after the 2nd injection is done. One masking film is added before the 2nd injection. The film is heat-transfer film which can use a predetermined temperature or pressure by machine operation to transfer the artwork, indicia, color, characters, design to the plastic-piece's surface. This will cause light transmitting having a very good appearance with a simple process. This embodiment also may the features described in the current inventor's patent US 5,572,817, as discussed above. The cosmetic appearance of the surface of plastic-piece (032) may also be modified by adding extra particles, resins, powders, ink, colors or equivalent material(s) to cause the light to transmit with visual change effects. A simple method is add extra materials inside the injection material input tank (037) to be mixed with plastic-piece original materials.

As shown in Fig 4A, the plastic-part (4A) has the two radius parts (4A01) and (4A01'). The plastic-part (4A) is sealed two sheets of EL-Elements (4A08) and (4A09), each of the EL elements having desired lit-areas including lit area (4A02) of EL-element (4A09). The lit-areas (4A06) and (4A07) are for EL-element (4A08). Each lit-area is positioned relative to a certain window to get desired light optics properties such as the lit-area (4A06) positioned over window (4A03), which is a convex lens. The lit-area (4A07) of flowers are positioned with respect to window (4A04), which is a convex and raised lens for magnifying optics properties. The lit-area (4A02') is positioned relative to the convex lens (4A01') for enhancing the whole EL-element's lit-area. Fig 4B shows a V-shaped EL-element (4B) which has a plurality of lit-areas (4B01), (4B02), (4B03), (4B04), (4B06) positioned with respect to upper windows having different treatments including 2-shaped raised lens (4B10) related to the backlight (4B01).The star-shaped raised lens' window (4B09) is positioned with a lower lit-area (4B02). The flower shaped lens' window (4B08) is positioned over

the lower lit-area (4B03). The thunderbolt-shaped window (4B04) is positioned over a lower lit-area in the shape of a backlight design. The Silkscreen printed window (I) and heart-shape (U) of the plastic-piece may include alternative treatments such as cut-outs, masking, stencil, heat-transfer art work, or a raised lens in front of the lower backlight's lit-area.

As shown in Fig 4C, the added particles, materials, and reflective pieces can enable the light transmitting channel to change and make diffusion light effects. The Plastic-piece (4C) has an EL-element inside, which emits light outward. The Plastic-piece has mixed other particles or materials (4C02) to change the inner light beams' pathway and create special light effects.

As shown in Fig 4D, the heart shape micro-injection pieces (4D) (4D') both have windows to allow light to pass though from the areas (4D01) (4D02) (4D04) (4D05), (4D07). Each window has a lit-area positioned to provide different colors and different light

effects as required. Both Heart-Shaped Micro-Injection pieces are made by human labor to inject a liquid material into the different grooves of areas (4D01) (4D02) (4D04) (4D05), (4D07) with light passing though. Both also have a stitching edge (4D03) and (4D06) to enable stitching to any main object.

As shown in Fig 5, the EL-element (05A) is sealed inside the plastic-piece with two inner buss-wires incorporated with two of the conductive-means (058+) and (058-) on both ends. The Pin-type conductive means (058+) and (058-) can easily to connected with a socket set's receptacles (059+) (059-) respectively. The electric-signal from socket (058+) though the buss-wire inside the plastic-piece to the end (059+) is the same electric signal except for tiny differences resulting from the electric resistance of the buss-wire material. A large voltage, frequency, and current change are not required because the buss-wire has sufficient amount of signals to offer to a plurality of EL-elements to connect to a desired length. The 1st EL element (05A) to the last EL element

(05I) will have .the same brightness because each of the EL-elements drain less current from Buss-Wire since all EL-elements are connected to the buss-wire by a parallel connection as long as the Buss-wire can carry enough signals (Currents)This solves the problem with the ELAM (Israel-US 5,485,355) 3D EL element of limited current carrying capacity of its outer coil electric-pole. The current inventor has related utility patents US6,270,229 and US 6,082,867. Hence, the use by the current invention of Signals) and the parallel connection of all EL-elements with the center buss-wire(s) can make a big improvement for connecting an unlimited number of EL-elements to for a combined lighting arrangement having a desired length, configuration, loop, or linear path for indoor and outdoor lighting application and other purposes.

As shown in Fig 5, the Buss-wire(s) have conductive-means (058+) and (058-) exposed to the air. The current carried from conductive-means (058+) and (059-) travel through the buss-wires of EL-element (05A)

to ends having the conductive-means (059+) and (059-), respectively. The voltage, current, and frequency measured at the two ends of EL-Element (05A) are almost the same with limited tiny changes based on the buss-wire(s) internal electric-resistance. The outside conductive-means (059+) and (059-) are connected with Receptacle (S1) to be connected with outside conductive-means (060+) and (060-) of EL-element (05B) respectively. The electric signals travel through the EL-element (05B) to the other end's conductive-means (066+) and (066-). The Measurement for the current voltage, frequency, current will keep almost the same as signals are carried by the conductive means along the following simple path:

(058+)→(05A)→(059+)→(S1)→(060+)→(05B)→(066+)→(S2)→(067+)→(05C)→(062+)→(S3)→(064+)→(065+)→(068+)→(069+)→(070+)→(071+)→(072+)→(073+)→(073+)→(074+)→(076+)→(077+). This means the voltage, frequency, and current amount undergoes only tiny changes from the start point to the application end. This is a big improvement for the conventional Christmas light

string made of Israel (ELAM) EL wires. The same is true for the negative current along the above-listed travel path.

The EL-element within the individual unit, such as (05A), (05B), (05C), (05D), (05E), (05F), (05G), (05H), (05I), (05J), is twisted around the center buss-wires (052) and (052') and incorporate the preferred receptacle-means to with outside signals or another device, and which can easily be constructed to have a desired length, configuration, or shape for market requirements. The EL-element's electrode (055) is connected with buss-wire (054) by soldering on terminals which are punched through and clamp on the electrodes. The terminal can be any shape as long as it is conductive for electricity. The individual device which has the EL-element with plastic sealing and receptacle-means can be installed in any application, such as a garden light, fish tank, balloon or other applications or utilities. The receptacle-means main purpose is to offer a receptacle to receive the EL-element's exposed conductive-means, or to offer

attachment-means to attach to the application or utility. The receptacle-means can have multiple-ends to receive a plurality of exposed EL-element's conductive means. It also can have attachment-means at a certain location to enable installation on main-objects so as to allow the individual device to be joined with a main-object for desired construction, the device serving as a light means with receptacle as base or as attachment-means.

The EL-element's other electrode (056) is connected with a buss-wire (057) by soldering. The buss-wires (052') and (052'') have two ends with electric wires outside the plastic skin. In order to make a good arrangement, the buss wires (052') and (052'') may be provided by a wire factory as a pre-cut arrangement(054'), (057') so there is none of the risk entailed by soldering work on the EL-element electrode (055') and (056').

Receptacles (S1), (S2), (S3), (S4), (L1), (L2), (Y1), (X1) may have desired designs and construction as needed

to meet the requirement to fit all kinds of linear curvature, curvilinear, loop, or path for universal fit in a variety of applications. The receptacle may have all kinds of shape for compatibility with a Bulb tube light set etc. The current invention offers an environment sealing process for EL-element(s) with durable such as resistance against a bend, scratch, water, humidity, impact force, ultra-violet ray, pull, twist, press, or punch. The Receptacle shape may selected from the "L", "S", "Y", "T", "X" type to allow the EL-elements in tube construction to be assembled into any linear curvature requirement. These listed shapes are preferred embodiments and do not limit the scope of the current invention.

Although preferred embodiments of the invention have been described in, it will be appreciated that the scope of the invention is not to be limited to the described embodiments, but rather that the invention is to be interpreted in accordance with the appended claims.